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SOME REFLEXIONS ON EPISTEMOLOGY, DESIGN AND PLANNING THEORY

by

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ABSTRACT

The debate in planning theory is focused on the link between knowledge and action. Epistemological assumptions are necessary to determine what this kink *is* or what it *ought to* be. The point of view chosen to discuss that link is that of Jean Piaget's genetic epistemology which belongs to the dialectical tradition. The "objectivity" of theory *in* planning, the concepts of rationality and optimality are discussed. The implications of a Piagetian paradigm for the respective nature and role of a theory of planning and of a theory of design are presented and these views are compared with those of other authors.

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I Theories of planning and epistemology

The current debate in planning theory

The current renewed interest for planning theory has several origins: the desire of practicing planners to give a meaning and some usefulness to their role in society; the need felt by academic planners to understand the link between methodology and theories on one hand, actual planning practice, on the other hand, possibly with planning education in mind (See Faludi, 1973a, 1973b, 1978b; Harris, 1975, 1978); the need felt by some planners to improve by means of planning the distribution of power in society (See Davidoff, 1965; Friedmann, 1973); and finally the need of the adepts of a critical or radical view of planning to give more theoretical foundation to their dissatisfaction with current practice and current methodology (See Scott and Roweis, 1977; Goldstein, 1975; Goldstein and Noyelle, 1977). Following Harris (1967) and Faludi (1973a), we will make the distinction between "theory *in* planning", i.e. the social sciences that can be used in planning (urban economics is an exemple) and "theory *of* planning", i.e. a theory concerned with the action of planning as such and not with what is being planned. The theory *of* planning itself can be subdivided into two theories: a procedural (or normative) theory of planning concerned with how planning *ought* to be done and a positive (or explanatory, or empirical) theory of planning concerned with how planning *is* being done or with the social nature of planning itself. There seems to be a consensus about these logical distinctions among different authors although the precise meaning attached to each concept, the connections between theories *in* planning, procedural and positive theories *of* planning, as well as the

relative importance given to one theory or the other depend on each author's particular views.

There is by now a voluminous literature on planning theory and, at the risk of simplifying and of not doing complete justice to the richness of each author's views, we can make the following typology of these works: first, the theories of planning conceived as general theories of decision-making (see Davidoff and Reiner, 1962; Faludi, 1973b; Harris, 1975, 1978); second, the "advocacy planning" theory (see Davidoff, 1965); third, the "new humanists" (see Friedmann, 1973); fourth, the "critical theorists" (see Goldstein, 1975); and fifth the "Marxists" (see Scott and Roweis, 1977; Goldstein and Noyelle, 1977). With the exception of the fifth group, more concerned with explaining "the facts of planning" than with procedural theory, all other theorists are concerned with the latter. Harris' recent works (1975, 1978) represent the best expression to date of the theory of planning conceived as a general theory of decision-making in a social context, but not necessarily as a specifically urban theory. It is the continuation of a long and respectable tradition of which Simon is a well-known representative (see March and Simon, 1958; Simon, 1969). In his book, Harris presents an original way of looking at social decision-making by using mathematical programming as a paradigm, rather than as a tool. This allows him to point at some shortcomings of different styles of planning, to characterize "intrinsic" difficulties of planning and to indicate simultaneously the possibilities and limitations of such well-known techniques as mathematical programming, simulation models, econometric techniques and cost-benefit analysis. For the "advocacy planning" movement

(see Davidoff, 1965) urban planning is conditioned by the distribution of power in society, with the consequence that powerless groups can find themselves without a technical expertise. It is proposed that planners put their technical expertise at the service of disadvantaged groups so as to counterbalance the unequal distribution of power. The emphasis of this approach to normative planning is on public participation. For the "new humanists" (see Friedmann, 1973) planning should be done through mutual learning. They deemphasize any scientific approach and emphasize personal knowledge, communication and dialogue as a way of solving society's problems. Goldstein (1975) shares Davidoff's concern for the inequalities in the distribution of power in society and Friedmann's distrust of scientific or technological approaches to planning. His ideas are inspired by the Frankfurt School's pessimistic view of science and technology in modern society (see Jay, 1972; Habermas, 1970, 1971, 1973; Horkheimer, 1972) and lead him to recommend political action. For Goldstein and Noyelle (1977) or Scott and Roweis (1977), a theory of planning should be concerned with explaining the origin and evolution of planning by replacing it in the larger context of the historical evolution and transformation of the capitalist mode of production. These authors base their views on a Marxist social theory: urban planning is one particular aspect of the intervention of the State in the functioning of the capitalist mode of production. As such its role is either to help maintain the "social and property relations" of the capitalist system (see Scott and Roweis, 1977) or to help avoid crises in the accumulation of capital by maintaining effective demand (see Goldstein and Noyelle, 1977). Goldstein and Noyelle's views are based on

Baran and Sweezy's Keynesian interpretation of Marx (see Baran and Sweezy, 1966). This group of planning theorists considers the decision-making tradition either as vacuous (see Scott and Roweis, 1977) or apologetic (see Goldstein and Noyelle, 1977). I consider that the most articulate and internally consistent procedural theory of planning is that of Harris and that the most articulate and internally consistent positive theory of planning is that of Scott and Roweis - Goldstein and Noyelle. (Although there are some differences between Scott and Roweis on one hand and Goldstein and Noyelle on the other hand, concerning their actual theories of the origin and evolution of planning in the capitalist mode of production, they are so close in their views about what a theory of planning is, as to be indistinguishable in that respect.)

Necessity of an epistemological viewpoint to assess alternative theories of planning

As expressed by the title of a guide to the literature on planning theory (see Friedmann and Hudson, 1974) the focus of attention of the renewed interest in planning theory is on the relationship between knowledge and action, and more particularly on the relationship between social knowledge and social action. And indeed the major concern of a theory of planning should be the link between knowledge and action. At this level of generality this view can encompass and indeed has encompassed widely divergent conceptions of planning theory: as we have seen, the general view is that planning theory is concerned with what *ought to* be the link between knowledge and action. However one cannot solve that problem without first finding what *is* in general the link between knowledge and action, i.e. what

knowledge is and what the role of action in its constitution is. This is the proper concern of epistemology. Therefore a theory of planning is dependent on a conception of epistemology and indeed this paper will attempt to answer questions about epistemology in general before answering questions about planning theory.

Some authors are quite explicit about their epistemological assumptions. For instance, in their classical article, Davidoff and Reiner (1962) make an explicit reference to logical-positivist philosophers like Ayer and Carnap and to their belief that facts and values are distinct. Goldstein (1975) makes an explicit reference to the views of the Frankfurt School on the role played by the sciences in society. Faludi (1978b) makes an explicit reference to, and borrows from, Karl Popper (1972) and his ideas on the methodology of science. For some other authors only implicit assumptions of an epistemological nature are made. For instance the "new humanists" make use of concepts like *mutual learning* and *personal knowledge* and deemphasize the scientific methods of deduction and controlled experimentation. This raises the problem of the existence of a mode of knowledge distinct from scientific knowledge: this is indeed postulated by para-scientific epistemologies such as Bergson's intuitionism or Husserl's phenomenology but there is no explicit reference to such philosophers in Friedmann's book (1973). In one of his articles Britton Harris (1966) states: "The problem of theory construction or invention is, then, to make the *correct*[1] identification between a real phenomenon and a mathematical or logical statement regarding relationships". The assumption that there exists a *correct* fit between social reality and logic or mathematics,

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1 The italics are mine.

belongs to the logical positivist school of thought in epistemology although no explicit reference is made to this school of thought in the quoted article.

I would agree with Faludi's recent statement (see Faludi,1978b) that planning theorists should make known their philosophy of science. Different epistemologies can have an impact on planning in different ways. First, there exist to-day different theories of urban form or of urban growth. These theories can have a *direct* impact on policy (for instance, if they state that the private market allocates land efficiently among alternative uses, this suggests *no* planning as the optimal policy) or an *indirect* one by being embedded in predictive models and used for predicting the consequences of different measures (rent control, housing allowances, housing subsidies, etc.) Policies based on theories of urban form will be assessed differently if one believes in the neutrality of social science or if one believes that ideologies and values influence theories directly or indirectly. Second, different epistemologies may lead to different "procedural" theories of planning. For instance, if, following the phenomenological tradition, one believes that the human sciences should not use the same analytical methods as the natural sciences, one is led in particular to the complete suppression of the use of mathematical techniques in planning, and to the rejection of the so-called "rational paradigm" of the planning process.

Why Piaget?

The epistemological point of view chosen here will be based on Jean Piaget's

genetic epistemology. Several reasons justify an interest in Jean Piaget's epistemological ideas. First, his merit has been to show that epistemology could be a *scientific* activity subject to the same kinds of mutual deductive and experimental controls that exist in the sciences in general. Traditionnaly epistemology was considered part of philosophy: it was a matter of philosophical taste if, for instance, one gave mathematics a Platonician, empiricist or Kantian interpretation. If we follow Piaget, it is no longer a matter of taste but an object of scientific investigation. Not surprisingly, as we will see in the next section, the answer obtained by Piaget's investigation to the question of the origin of mathematics is none of the traditional interpretations. One can explain Piaget's new approach to epistemology as a result of his first training both as a biologist and as a philosopher. He writes himself (see Furth, 1969): "My higher education focused on the fields of biology and philosophy, ... This training was extremely useful for my subsequent psychological investigations and formed in me the habit of thinking simultaneously in terms of adaptation to the environment and in terms of an interiorly regulated development on the part of the subject. While I wanted to devote myself to biology, I had an equal interest in the problems of objective knowledge and epistemology. My decision to study the development of the cognitive functions in the child was related to my desire to satisfy the two interests in one activity. By considering development as a kind of mental embryogenesis, one could construct a biological theory of knowledge". Second, an interest in Piaget is justified by the fact that his views are largely supported by some works in the history of the sciences (see Kuhn, 1962; Dobb, 1973). Third, his findings are not proved but at least made plausible by some

works done in the field of artificial intelligence, in particular in the Artificial Intelligence Laboratory at the MIT (see Winston, 1970; Winograd, 1971; Hewitt, 1971; Minsky and Papert, 1972): his ideas are plausible in the sense that they can be "implemented" in computer programs. To anticipate, for Piaget, knowledge is embodied in *schemes*, i.e. the patterns of action an individual has in his interaction with the external world, and the concept of *scheme* is analogous to the concept of *procedure* in computer science. Therefore, there is a natural transition between a structuralist approach to the psychology of cognitive processes such as Piaget's and artificial intelligence as conceived by the researchers of the MIT team. This is acknowledged by Minsky and Papert themselves (1972) in one of their progress report. Fourth, Piaget's views are consistent with the dialectical tradition in the social sciences in general (see Goldmann, 1966, 1967, 1970). And, last but not least, his genetic epistemology appears to reconcile and synthesize in many ways several of the major traditional philosophies of science, such as Kantism, Empiricism and Hegel's dialectics, although it is not to be confused with any of them.

Nevertheless, one has to admit that no epistemology can been shown to be absolutely "*true*", Piaget's epistemology included, if only for the simple reason that criteria for truth in epistemology remain to be defined and it is doubtful whether a consensus on such criteria could ever be reached. It would be consistent with the point of view adopted in this paper to say that one can only approximate "truth" rather than obtain it, and that many such approximations are *a priori* plausible.

Questions to be answered and organization of the paper

Some questions will be concerned with epistemology and theory *in* planning, others with the theory *of* planning, normative or explanatory.

The first set of questions is concerned with the nature of knowledge in general: what are the respective roles of the subject and of the object? Is there a clearcut distinction between knowledge and action? What role, if any, does language play in the constitution of knowledge? What is the role of experimental psychology in answering questions related to the nature of knowledge? What is the validity of traditional epistemological viewpoints such as empiricism, Kantism, Platonism, phenomenology, dialectics? A second set of questions has to do with the role of mathematics in causal explanations: what is the status of experimental knowledge and its relationship with logico-mathematical knowledge? This question itself raises the problem of the respective origins of logico-mathematical knowledge and of experimental knowledge? A third set of questions is concerned with the nature of the distinction that should be made between the social sciences and the natural sciences: can theories in the social sciences have the same "objectivity" as in the physical sciences? Do the social sciences differ from the natural sciences by their methods? The phenomenologists for instance make a distinction between *comprehension* as a mode of knowledge valid for the *Geisteswissenschaften* and *explanation* as a mode of knowledge valid for the *Naturwissenschaften*. How valid is this distinction? Many modern theories of urban form are based on microeconomic theory. Is economic theory objective? Does ideology play an important

role in economic theorizing as Marxist economists generally think? A fourth set of questions is concerned with the role that the sciences play in Society: are they simply a means of societal control in the hands of the dominant classes of society, as suggested by the Frankfurt School or do they have some autonomy? A fifth set of questions is concerned with the status of the concept of rationality in planning theory. What kind of rationality is planning aiming at? Is it a search for optima? What is the status of the so-called "rational paradigm" of the planning process? What is the role of techniques such as systems analysis, operation research, cost-benefit analysis? Can one delimitate a frontier between a theory of planning and a theory of design? A sixth set of questions is concerned with the nature of a theory of planning. What functions would a theory of planning serve? What approaches would it use? What should be the role of historical methods and of formalization in the development of a theory of planning?

This paper will make a few steps towards answering these questions and is organized as follows: Section II presents Piaget's views on epistemology; after a definition of the nature and methods of a scientific epistemology, it presents traditional viewpoints and then that of Jean Piaget's genetic epistemology. The consequences of Piaget's findings for causality, logic, mathematics and experimental knowledge are presented in detail. Section III is concerned with the implications of genetic epistemology for the social sciences in general and economics in particular. It will focus on the problem of the "objectivity" of the social sciences. Section IV is concerned with planning theory. After stating the consequences of Piaget's

viewpoint for planning theory, it discusses the concept of rationality, the respective roles of a theory of design and of a theory of planning, outlines the functions, nature and methods of a theory of design and of a theory of planning. The point of view taken in this paper is then compared with the views of other authors. The last section concludes the paper.

II Piaget's views on epistemology[1]

Nature and methods of a scientific epistemology

The nature of epistemology is defined as follows (see Piaget, 1967b): epistemology is the study of the constitution of valid knowledge. This definition refers to the conditions of accession to knowledge as well as to the conditions which are constitutive of valid knowledge and has several consequences: 1) It refers to valid knowledge, which is the area of logic, but also to the conditions of accession, which is a question of fact. 2) The conditions of validity or accession are not necessarily the same for different kinds of knowledge: e.g. mathematics and biology. 3) The word accession shows that knowledge is considered as a process and not as a state. 4) The constitutive conditions of knowledge refer to conditions of formal validity as well as to experimental validity. What comes from the object and what comes from the subject in the structuration of knowledge? For instance: is knowledge a pure registering of the external world by the subject or does the subject actively participate in the process of knowledge? 5) In order to determine the respective roles of the object and of the subject in knowledge, it is necessary to know the conditions of accession to knowledge because the role of the subject is not

1 This section was largely inspired by Piaget (1967a).

apparent in a given "achieved" state of knowledge. Hence the importance given by Piaget to the historical and genetic methods in epistemology. These remarks lead to a second definition of epistemology, a genetic definition: epistemology is the study of the passage from states of lesser knowledge to states of greater knowledge.

From the preceding definitions of the object of epistemology, three conditions on the methods of epistemology can be derived. 1) Nothing valid can be said about the nature of the principles, methods or concepts at stake without knowing their actual use in the field concerned and without criticizing them directly within that field itself. 2) Any question of formal validity belongs to the realm of logic. 3) In addition to questions of formal validity, a large number of questions of fact arise concerning the role and the activities of the subject in the process of knowledge. Three kinds of methods are associated to these three conditions: 1) Methods of direct analysis: these methods attempt to state by reflexive analysis, the conditions of knowledge at stake, when a new body of scientific theories arises, or when a crisis arises. 2) Methods of formal analysis: these methods add to the direct analysis of the processes of knowledge, a critical examination of the conditions of their formalization, and also of the coordination between this formalization and experience. 3) Genetic methods: they attempt to understand the process of scientific knowledge, as a function of its development (or genesis). There are two kinds of genetic methods: - the methods concerned with the sociogenesis of knowledge (or historical development among human societies) and its cultural transmission. - The methods concerned with the psychogenesis of

the concepts and operative structures formed during the development of individuals. The methods of the first kind are historical methods: they attempt to study the origin and development of a present body of knowledge. The methods of the second kind are the methods of genetic epistemology: by a combination of psycho-genetic analysis and formalization of structures they attempt to uncover the psychological conditions of the formation of knowledge and to coordinate these results with the study of the conditions of formalization.

Traditional epistemological viewpoints - The problems that they raise

Following Piaget, we will distinguish three categories of theories of knowledge: 1) the *metascientific* theories which start from a reflexion on the sciences of their time and extend this reflexion into a general theory of knowledge. 2) The *parascientific* theories which are based on a criticism of the sciences and attempt to reach a mode of knowledge distinct from scientific knowledge (or in opposition to scientific knowledge). 3) The *scientific* theories which remain within a reflexion on the sciences. Metascientific theories of knowledge were elaborated by Plato, Aristoteles, Descartes, Leibniz, Kant, Hume and Hegel. We will discuss the epistemologies of the last three philosophers because of their importance for modern thought. Kant's theory was based on a reflexion on Newtonian physics. His main problem was the origin of the harmony between the deductive instruments of mathematics and the data of experience. His answer was that the subject possesses *a priori* synthetic structures (space, time, causality...) in addition to analytic structures forming the logico-mathematical apparatus. These "*a priori*" structures

impose to perceptions and experiments in general a structure compatible with mathematical deductions. They are pregiven in some sense which raises the psychological question of the nature of these "pregiven" structures. An example of an "*a priori*" structure in modern science is Chomsky's concept of linguistic competence. Chomsky assumes that it is hereditary but Piaget disagrees. For the empiricist theory of knowledge all knowledge is derived exclusively from experience, sensations (Condillac) or repeated associations (Hume). It is the implicit epistemology of common sense and therefore the epistemology of most planners or planning theorists. This view of knowledge, which assumes the existence of pure facts, presupposed results of an experimental psychology that was yet to come. Hegel's dialectics was based on a reflexion on history. For him, knowledge proceeds by thesis, antithesis and synthesis. His philosophy is at the origin of Kark Marx's own philosophy of science and in fact anticipates Piaget's own findings on the development of cognitive processes. Parascientific theories such as Bergson's intuitionism and Husserl's phenomenology were elaborated as a reaction against materialist and positivist methaphysics and attempted to delimit clearly a domain for scientific knowledge and a domain for another form of knowledge (intuition). The central idea of phenomenology is the following: there is an intuition of "*essences*". These "*essences*" are inseparable from the "*phenomena*" or "*facts*" and we go from the fact to the essence by a process of *reduction*, consisting in freeing ourselves from our natural limitations. Phenomenology attempts also to duplicate experimental psychology by a phenomenological psychology that would be founded on "intentionality". There is a radical separation between *Geisteswissenschaften* and *Naturwissenschaften*:

comprehension is adapted to mental phenomena while *explanation* is relevant to the natural sciences. Scientific epistemologies attempt only to explain scientific knowledge and not knowledge in general, either because they consider scientific knowledge as the only possible form of knowledge or because they consider it their duty to interpret it for itself. The fundamental fact which characterizes these epistemologies is that they were born because of crises and not because science was considered achieved. Two sources (among others) can be assigned to the scientific epistemologies: 1) The scientists themselves have more and more been concerned by epistemological problems, not for the pleasure of philosophizing, but to overtake the crises occurring in science, when these crises are not simply the result of divergences on experimental results, but when the very concepts or principles used to obtain the results are challenged. 2) Given the continuous transformation of the sciences, some epistemologies have attempted to fix once and for all the principles of Science in a system of norms: this is the origin of positivism. The epistemology internal to the sciences ceases to be simply a reflexion on science; it becomes an instrument of the progress of the sciences as an internal organization of the foundations of the sciences and it is elaborated by the very same people who will base their work on this reflexion. For example, Hilbert, Bernays and Ackermann wanted to demonstrate the non-contradiction of arithmetic and lay the foundations of geometry on a purely axiomatic basis, forbidding any recourse to intuition. The dream of Hilbert was to make this demonstration using only instruments belonging to arithmetic. This dream turned out to be unachievable, because of Gödel's theorem, proving, loosely speaking, "the impossibility of proving the non-contradiction of a system by means of only the instruments belonging to that system or

weaker means": in its second part, Gödel's theorem (which applies to formal systems which can be interpreted as arithmetic), states that, in these systems, *there exist undecidable propositions*, i.e. propositions which are neither derivable, nor refutable. (A proposition is derivable, when it can be derived from the axioms by the transformation rules; a proposition is refutable when its negation is derivable in the system.) (See Delong, 1970). Because of its modern importance much attention will be devoted to positivism. The purpose of this epistemological approach is to stabilize the sciences, by delimiting frontiers between science and metaphysics and by fixing once and for all the principles and methods of the sciences. This was already the program of Auguste Comte. The present neo-positivism of the Vienna Circle and the logical positivism of the Anglo-Saxon world have made some progress since Comte. In particular, logic plays a dominant role in logical positivism. Since it is also the case with Piaget's genetic epistemology, and since logical positivism is still predominant in North America, it is worth comparing it with Piaget's approach and examining in more detail its basic assumptions.

Logical positivism was born in Vienna from the convergence of two streams of thinking: first Mach's empiricism according to which any experiment can be reduced to sensations; second, the logicist school, founded by Whitehead and Russel. Shlick, who founded the Vienna Circle in 1924, wanted to synthesize empiricism and logic: logico-mathematical structures are considered as a language, which is tautological and whose only function is to describe adequately the truths of experience. The program of this school of thought was to reach the unification of scientific knowledge and to find a method common to all sciences, which can provide

guarantees against the accumulation of meaningless concepts or pseudo problems. One of the most influential modern adherents to this school of thought is Popper. Two conditions must be satisfied for this program to be possible: first, the respect for the facts; second, the elaboration of an exact and common language. Logic is supposed to be that language. It has no other power than to combine signs (logical syntax) and meanings (logical semantics) according to certain rules (pragmatics). This reduction of thought to language tends to reduce to a minimum the role of the subject in the process of knowledge: his role is only to combine signs. Given these programs and methods the logical positivists solve the problem of the adequation of our logico-mathematical apparatus to the external world by these two related answers: all logico-mathematical truths can be reduced to tautologies. (The logical positivists use the word tautology in two meanings: - identities (dogs are dogs) - judgements considering identically all the possibilities (either x is a dog or x is not a dog)). There is a clearcut distinction between *analytic* (or tautological) relations and *synthetic* relations, the latter concerning exclusively experimental knowledge. This means that any formalization of logical or mathematical truths will eventually reach "tautological expressions", which, by a suitable choice of axioms or inference rules, can be transformed into identities. Consequently, there is a radical separation or dualism, between experimental or empirical knowledge and logico-mathematical knowledge: on one hand is a language, which is purely tautological; on the other hand, are the facts, which cannot be reduced to the language and produce a synthetic knowledge depending on experience alone, and not at all on the logico-mathematical language. The language is used to describe the facts but does not play any role in their constitution. Without being

concerned by a genetic analysis, logical positivism nevertheless assumes two psychogenetic facts without verification. 1) The origin of analytic (or logico-mathematical) relations is to be found in language. 2) The origin of synthetic (or experimental) relations is to be found in perception. These assumptions should not rely on a formal analysis but on questions of fact: they call for a genetic analysis. And in fact an essential result of the genetic analysis of logico-mathematical structures (see Beth and Piaget, 1961) is that these structures have roots which appeared before language; they have their origin in the coordination of actions. These actions are the starting point of what will become operations of thought. On the other hand, genetic analysis confirms the distinction between logico-mathematical knowledge and experimental knowledge, but it attributes to this opposition a very different sense, as will be discussed further below. Concerning perception, a result of genetic analysis shows that at all levels of development, perception is linked with action: this means that, if it is true that there exists a "pure" logico-mathematical knowledge, there is no "pure" physical or experimental knowledge, completely independent of logico-mathematical knowledge, however elementary. As a result, the duality analytic knowledge / synthetic knowledge is untenable.

The logical positivists have had the merit of insisting on formal analysis as an important tool to epistemological research, but they have transformed the method into a doctrine, or even a dogma, the dogma that science can be "closed". This is a very important drawback of the logical positivist school of thought and it comes from the fact that it has taken a synchronic point of view on scientific knowledge: science is a state

instead of a process, and therefore the role of the subject disappears. The perspective changes as soon as the question of the origin and development of the sciences is raised. To the essentially static methods of logical positivism, a *dialectical point of view* must be substituted, in order to reconcile the genesis of structures and the possibility of their formalization at each equilibrium stage and in order to understand at each state of cognitive development, the respective roles of the object and of the subject.

Jean Piaget's genetic epistemology and its implications for logico-mathematical knowledge, experimental knowledge and causality

As mentioned in the preceding paragraph, all theories of knowledge whatever their origin, make assumptions of a psychological nature which cannot be accepted without further experimental verification, i.e. without recourse to psychology. This idea was at the origin of Piaget's genetic epistemology.

The main hypothesis of Piaget's biological theory of knowledge is that the development of knowledge prolongs without discontinuity the functioning of living organization (see Piaget, 1967e): "Cognitive mechanisms are an extension of the organic regulations from which they are derived. These mechanisms constitute specialized and differentiated organs of such regulations in their interactions with the external world." Knowledge "adapts" to the external world through the twin processes of *assimilation* and *accommodation*. In order to understand these two processes one has to understand first the concept of action *scheme* which, by definition, is what can be transferred, generalized or differentiated from one situation to the next in an action, i.e. what is common to several repetitions or

applications of the same action. Analogous concepts are the concept of *procedure* in computer science and the concept of *algorithm* in mathematical programming. (Indeed many recent works in artificial intelligence are a proof of the fruitfulness of the analogy.) Any knowledge of an object implies an action on this object which incorporates this object to action schemes of the subject (assimilation) and which can transform the action schemes themselves (accommodation): to pursue the analogy with mathematical programming, the process of accomodation means that the algorithm itself can be modified whenever it is applied to a different problem.

Knowledge therefore is viewed as a dialectical process of interaction between the subject and the object, in which the structures of the subject are constructed progressively. There are successive equilibria corresponding to the integration of the structures at level n into the structures at level (n+1) so that part of a structure at level (n+1) is isomorphic to an entire previous structure at level n. These successive equilibria are the result of a process of self-regulation. This view of the development of knowledge in children carries over to the evolution of scientific knowledge in the natural sciences, also characterized by a progressive differenciation and reconstruction of theories with integration of the previous theories in the subsequent ones: one well-known example of this process is the integration of Newtonian physics into Einsteinian physics. Piaget's ideas on the evolution of the natural sciences are different from Kuhn's (1962, 1970a, 1970b, 1974) for whom the succession of scientific paradigms does not appear to represent a clear sense of progress. However Piaget's conception of individual learning and of the development of knowledge and Kuhn's conception of the development of the sciences

have in common their insistence on discontinuities (Kuhn's scientific revolutions and Piaget's stages of intelligence).

These hypotheses about human intelligence have been verified experimentally by Piaget and his collaborators (see Furth, 1969; Piaget, 1972, 1978) and we will present below the results of their research concerning the nature of logic, mathematics and causality. However, several answers can be made at this point concerning the distinction between the subject and the object in the development of knowledge as well as the role of action in the constitution of knowledge: no clearcut distinction exists between the subject and the object of knowledge because no knowledge occurs without actions of the subject on the object and neither empiricism nor a priorism represent valid theories of knowledge.

The origin and nature of logic and mathematics is fundamental for an understanding of the nature of scientific knowledge because logic is a formalization of the rules of deduction and because the external world seems to obey mathematical laws, with the consequence that this harmony has to be explained. The main result of the studies done by Piaget is that there is a real continuity between the way logico-mathematical structures are constructed by children and the way mathematicians and logicians construct new structures. He calls this common process *reflective abstraction*. The latter is characterized by a progressive dissociation of form from content, for instance the construction of operations on operations. An example of such a process in mathematics is the passage from the integer numbers to the rational numbers. The first structures constructed by the child find their origin in the laws of the general coordination of actions. They are discovered by means of logico-mathematical experiments, utilizing

concrete objects in the early childhood; but soon these concrete objects are replaced by abstract objects. The difference between form and content in logico-mathematical experiments is relative to the stage of development. A form for the structure at level n , becomes a content for the structure at level (n+1). A logico-mathematical experiment proceeds by abstraction from the actions on the objects and not by abstraction from the objects themselves as in physical experiments. This distinction is explained by Piaget himself (see Beth and Piaget, 1961): "When a child discovers that a big rock is heavier than a small one, it is a physical experiment, because, ..., the subject discovers a property which was in the rocks before he weighed them: it is an abstraction from the objects themselves. On the other hand, when he puts five rocks in a row and finds out that the number five remains the same when counting from left to right or from right to left, he performs a logico-mathematical experiment because the experiment is not concerned with the objects as such but with the relationship between the action of ordering and the action of adding. The linear order was not in the rocks before action ordered them in a row..." Successive logico-mathematical structures are, strictly speaking, neither invented nor discovered but constructed: given a structure, many possible new structures can be constructed by reflective abstraction from this structure but it takes a mathematicians' work to actualize some of them. This constructivist interpretation of logico-mathematical knowledge leads to the two following questions: where does it start and where does it end? The answer to the first question is that the origin of logico-mathematical structures is to be found in the very functioning of living organization: since there is no living organization without a fundamental interaction with the physical environment, this in

turn explains the harmony between mathematics and the physical environment. The answer to the second question is that there is no end: the theorems on the limits of formalization (Gödel's theorem in particular) show that even logic cannot be fixed once and for all (see Beth and Piaget, 1961) but is in a process of construction and therefore that there is nothing absolute in the norms of logic.

Concerning causality, Piaget's research shows that it consists in attributing mathematical structures to the objects. Since these mathematical structures are themselves in continuous construction there is no absolute objective truth about the external world, even in the natural sciences, except in a limit sense.

Several conclusions can be drawn from these results. First, logico-mathematical knowledge is not a pure language but is genetically anterior to language and is in a process of continuous construction. Second, any experimental knowledge has to be interpreted within logico mathematical structures. Thus although there may exist a pure logic and pure mathematics, there cannot be a pure experimental science. Consequently the logical positivists' distinction between analytic knowledge and synthetic knowledge is spurious: there are no pure facts, and logic is more than a language.

III Implications for the social sciences, for theory *in* planning

Implications for the social sciences in general

Piaget's view of the process of knowledge is that of a dialectical process of interaction between the subject and the object. This epistemological view, as noticed by Goldmann (1966, 1967, 1970) is similar to Marx's philosophy of science by its emphasis on human action: social knowledge depends on social practice.

Piaget's structuralist epistemology emphasizes the importance or formalization in causal explanations (see Piaget, 1967a, f). The social sciences do not differ from the natural sciences by their methods as was thought by the phenomenologists. In fact the physical sciences have borrowed methods from the social sciences as much as the social sciences have borrowed methods from the physical sciences (see Piaget, 1967f): information theory provides an example of a formal theory which found applications in the two domains. Genetic epistemology demonstrates the relative autonomy of the development of the sciences, contrary to the Frankfurt School's gloomy view of science.

The last two implications of Piaget's views, i.e. the role of formalization and the autonomy of the sciences are shared with the logical positivist school. However Piaget's dialectical conception of social knowledge implies that there need not be *one* social science as there is *one* physical science. Human actions at the origin of the construction of causal structures in physics have their roots in the biological constitution of the human species and therefore an advanced degree of objectivity can be reached in physics: it can be the same in different societies or different cultures. On the other hand, social practice varies with social groups, societies, cultures, and, since the subject of the social sciences is simultaneously their object, the same degree of objectivity cannot be reached. The "decentering" process, i.e. the effort towards finding laws or structures by mutually controlled deduction and experimentation, is more difficult for the social scientist than for the natural scientist: values and ideologies play a greater role and they vary in particular with the social class or the culture of the social scientist.

This is far from implying that some degree of objectivity cannot be reached through mutually controlled deduction and experimentation. This means however that the kind of objectivity that one can reach in the social sciences is *conditional* on a certain world-view, itself in dialectical interaction with a social practice. We may conclude from there that one may have to accept the possibility of several competing paradigms in the social sciences.

The case of economics and of urban economics in particular

The history of economic thinking provides an excellent example of competing paradigms dependent on social practice. This in itself would justify devoting some attention to economics, but another reason is that economics as a social science has more impact on policy decisions in the most diverse areas of society than any other social science. In particular urban economics, as a subfield within the general field of economics may have had some impact on policies or the absence of policies in urban planning, directly, or indirectly by the conception of the city which it provides.

The possibility of competing paradigms in economics is well documented by the history of theories of value and distribution (see Dobb, 1973; Benetti, 1975, Benetti, Berthomieu, Cartelier, 1975). For the "neo-classical" school with its culmination in the Walrasian concept of a general equilibrium the remuneration of the factors of production, which include labour and capital, is determined in simultaneity with prices in general. The general equilibrium is an optimal and harmonious social state resulting from the attempt by each individual in society to reach

his best interest: the Walrasian equilibrium (especially in its modern formalizations) is an aesthetically appealing way of expressing Adam Smith's "invisible hand" idea. Some modern criticisms of the Walrasian theory, and in particular critical assessments of the logical necessity of the existence of an "auctioneer" come either from the neo-Keynesian disequilibrium school (see Benassy, 1976) or from the Marxist school (See Fradin, 1976, 1977). For the "classical" school represented by David Ricardo (1970) and its modern descendants, such as Piero Sraffa (1960), the distribution of income between wages and profits is logically prior to the determination of prices. For the neo-classical school as well as for the classical one only *relative* prices have meaning. Marx, however, defended a concept of *absolute* value of commodities and explained that profits originate in surplus value, the difference between the value of commodities and the value of the labor necessary to produce them. His theory differs from Ricardo's theory and from the neo-classical theory but it is fair to say that there is still an intense debate among Marxist economists about which interpretation of Marx's theory of value is the correct one. Gilles Dostaler (1978,a,b) gives an excellent historical account of the debates among Marxist economists and others that took place at the end of the XIXth century and at the beginning of the XXth century: he shows that some of the theoretical discussions that took place among economists of diverse schools at the time anticipated many of the present debates, though in a less formalized way.

The importance of social practice in the shaping of these different theories is evident. Maurice Dobb shows very clearly the importance that the

debate on free trade and the conflict between aristocrats and capitalists had on Ricardo's theory of rent and more generally on his theory of income distribution. David Ricardo was very much involved in the conflicts of his time: "Although the doctrines of the classical school were very abstract, especially in the form given to them by Ricardo, they were related very closely to practical issues of their day, indeed surprisingly closely". "A germ of his (Ricardo's) theories of value and distribution emerged in a topical pamphlet of February 1815 directed towards the debate of that same month in the House of Commons on the new Corn Law and towards establishing the theoretical case for free import of corn" (see Dobb, 1973, chapter I) Ideologies had a role to play in the development of economics: Louis Dumont (1977) shows the link between the economic theory of Adam Smith and the individualist philosophy of the Enlightment. Maurice Dobb (1973, p.37) aptly summarizes the link between theory and practice in economics in a way that is very close to Piaget's assimilation and accommodation concepts: "New concepts and theorems have to be envisaged simultaneously as being fashioned in response to (and hence patterned upon) older ones as critical assessment of their adequacy to fulfill the role for which they have been cast - and as a reflection of changing human experience and of the problems and conflicts involved in human social activity that is itself motivated by the use of abstract notions applied to human beings in general, to their artifacts and to things".

The origin of modern urban economics (see Richardson, 1977) is Von Thünen's (1826) agricultural land use theory. His concept of land rent, expressing savings in transport costs,as an allocator of land to the most efficient

usage is the direct ancestor of the modern concept of "bid rent" developed by Alonso (1964) in an urban context, on the basis of modern microeconomic theory. Most works following Alonso attempted to apply Walrasian general equilibrium theory to explain urban form: in all these theories land rent is conceived as an index of scarcity allocating urban land between alternative uses. The question is of course raised of the social optimality of the urban form resulting from the market land allocation. Since the existence of "externalities" in cities is widely recognized, many of the modern theories attempt in an an ad hoc and piecemeal fashion to provice guidance towards the correction of "market imperfections": for instance by determining optimal congestion taxes one would try to transform a market equilibrium which is not socially optimal into a socially optimal equilibrium; one would thereby "solve" the social problems resulting from traffic congestion. Boutaud (1978) provides an excellent critical review of a sample of these works and shows that they do not explain urban form: for example none of the theories reviewed explains the existence of a C.B.D. located precisely where it is located. This is a tremendous failure given the importance of the C.B.D. as a component of urban form. Boutaud argues that to try to explain social phenomena such as cities on the basis of assumptions on individual behavior is doomed to failure. Theoretical works in urban economics trying to explain urban form or some aspects of it, such as the functioning of the housing market, within a different paradigm than the general equilibrium paradigm, are extremely rare. Lipietz (1974, 1977) tried to analyze the functioning of the housing market and to explain the origin of land rent from a Marxist perspective and Scott (1976) tried to spatialize Sraffa's theory.

The dialectical interaction between theory and practice is quite clear in urban economics: one will not have the same land use policy if one believes that the price of land basically fulfills its role of allocating land optimally among alternative uses (granted that some taxes or subsidies have to be created to take into account externalities such as traffic congestion, air pollution, etc.) or if one does not believe so (see Roweis and Scott, 1977)

Similarly, the interaction between theory and practice appears obvious if we consider again the theory of income distribution. A national incomes policy is not going to be the same if one believes that the market pays labor at its "just" price, as the neo-classical school thinks, or if one believes that income distribution (the distribution between profits and wages as a first approximation) is exogenous to the functioning of the economic system and is the result of a conflict between "capitalists" and "unions" possibly arbitrated by the State, as is believed by the neo-Ricardian school (the so-called "Cambridge School"). It may not be completely by coincidence that the neo-Ricardian school has been flourishing in the United Kingdom, a country which has been governed mostly by the Labor Party since the end of the Second World War, showing rather transparently the link between social practice and theoretical development.

A value-free social science is impossible

In contrast to the positivist ideal, we have to accept the possibility of different competing paradigms in economics, sociology and all the other social sciences. Max Weber's ideal of a value-free social science

is impossible. This state of affair may be unpalatable for somebody, who, following the logical positivist ideal would like to believe in the Unity of Science but is unavoidable in a dialectical epistemology.

Some consequences on urban planning are worth mentioning at this point. As mentioned previously, a theory can guide policy directly and the practical impact will differ with the theory chosen. In addition to inspiring policy directly, different economic theories can have an *indirect* effect on policy through the use during the planning process of predictive models in which they are embedded (for instance the Herbert-Stevens model for predicting residential location (see Herbert and Stevens, 1960) is based on Alonso's theory of urban land use): the predictions and therefore the policies based on those predictions may differ with the underlying theories. One will not hold the same opinion of the proposed policies if one believes in the "objectivity" of social science or if one believes that the policies are *conditional* on a certain paradigm.

IV Implications for the theory *of* planning

Implications of Piaget's epistemology for theories *of* planning

Given the dialectical interaction between social knowledge and social action the distinction between theory *in* planning and theory *of* planning has to be qualified. As indicated in the previous section, social practice, values and ideologies play an important role in the development of theories *in* planning. A fortiori, values and ideologies play a decisive role in theories *of* planning concerned with social action as such.

Differences in epistemological viewpoints have an impact either on the

relative emphasis on procedural and on positive theories of planning, or on the very conception of a methodology of planning and of an explanatory theory of planning.

A positivist viewpoint will tend to emphasize a normative theory of planning because it tends to accept the objectivity of facts, problems, models and theories: problems tend to be viewed as technical. An "empirical" theory of planning is important only insofar as it can improve day-do-day planning practice and make it closer to the ideal of rational planning. For Faludi, for instance, "normative theory is concerned with how planners ought to proceed rationally "while" behavioral approaches focus more on the limitations which they are up against in trying to fulfill their programme of rational action". (see Faludi, 1973a). Thus positive theory is, at worst anecdotical, at best remedial or even put forward to show how limited in its effects urban planning really is (see Meyerson and Banfield, 1955). On the other hand, for a dialectical point of view, a positive theory is fundamental because it explains the origin, context and therefore the *possibilities* of planning and does not abstract from social theory in general, as if urban planning could be studied in isolation from the study of the functioning of Society at large. For instance, Goldstein and Noyelle (1977) explain the origin of planning by means of Baran and Sweezy's "surplus absorption" theory (see Baran and Sweezy, 1966), while Scott and Roweis (1977) see urban planning as arising from the need to maintain the capitalist "social and property relations".

Different epistemological views will lead to different conceptions of a

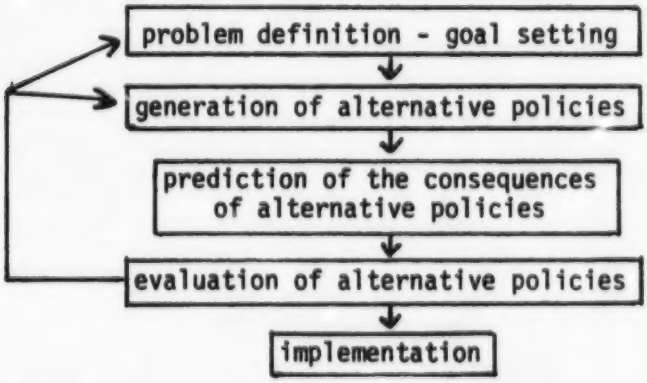
"normative theory". For Friedmann (1973) the belief in a mode of knowledge distinct from the deductive and experimental methods of the sciences in general, entails a distrust for formal methods or theories and a reliance on the virtues of communication. For the "Critical Theory" of Goldstein (1975) influenced by the Frankfurt School and its belief that science is not autonomous but a tool in the hands of the ruling class, all the methods of operations research, systems analysis, econometrics, etc... are harmful and planners should rely on political action. On the other hand, for a logical positivist viewpoint as well as for a dialectical viewpoint based on Piaget's genetic epistemology, scientific approaches are an indispensable part of any planning methodology.

Wrong epistemological views can have adverse effects on planning. The positivist view leads to the artificial separation between values and facts and therefore between Politics and Science, in the tradition of Max Weber. It leads to the exclusive emphasis on methodology and to the belief in the possibility of "absolute objectivity" if one could know "all the facts". Planning theory tends to be considered as reducing to a theory of rational decision-making. The intuitionism of the "new humanism" (see Friedmann, 1975) can lead to subjectivism and irrationality and to almost any kind of metaphysics, religious or other; it may not be completely by accident that this enthusiasm for the virtues of communication and dialogue occurred in California. The emphasis of "Critical Theory" on the use of the scientific method for increased societal control of the people and the maintenance of the existing social order is quite healthy after a long period of too much hope (especially in the U.S.A.)

in the tools of systems analysis and operation research for curing all social ills. However the case is pushed too far: political action without some theory and some methodology may produce counterproductive effects. Finally my own views on positive planning theory are close to those of Goldstein and Noyelle (1977) or Scott and Roweis (1977). However, for reasons that will be developed in the next paragraph, I think that these authors tend to neglect the importance of a "normative theory" of planning. This could lead practicing planners to the belief that they have no degrees of freedom in their profession: I myself share with Britton Harris (1978) the belief that they have more freedom than they usually think, within the constraints that the positive theorists such as Scott and Roweis have chosen as their duty to explain.

Rationality, planning theory and theory of design

The preceding discussion leads to a more thorough examination of the concept of rationality, in particular in the so-called "rational paradigm" of the planning process, which can be depicted as follows:


problem definition - goal setting
generation of alternative policies
prediction of the consequences of alternative policies
evaluation of alternative policies
implementation

Several types of mathematical models are proposed in this paradigm: design models for the "generation of alternatives" phase, predictive

models for the "prediction of consequences" phase, evaluation techniques for the "evaluation" phase. Optimization techniques such as linear programming can be used as design models, simulation models or econometric techniques can be used for prediction and cost-benefit analysis or multi-criteria analysis can be used as evaluation techniques. The problem definition and goal-setting phase is usually viewed as non-technical, and sometimes outside the professional role of the planner.

This paradigm conceives of the planning process as a general decision-making procedure independent of the particular subject-matter, whether it is urban planning, corporate planning, transportation planning, educational planning, etc... It has a long history (see Simon, 1969; Davidoff and Reiner, 1962; Harris, 1967, 1968a,b). Britton Harris' recent book (1978) constitutes a brilliant exposition of this paradigm.

This paradigm has been widely criticized. Most of the criticisms are directed implicitly at the notion that, once the problem and the goals have been stated, some form of absolute objectivity can be reached in the form of an optimal solution to the planning problem. This would imply a positivist epistemology and I will argue in the rest of this paragraph that the major limits of the "rational paradigm" are not due to the paradigm as such but to the "common sense" epistemology of most people supporting it, using it or even criticizing it.

The criticisms to the "rational paradigm" seem to fall into four categories. The first category of critics assumes that a mode of knowledge such as intuition, distinct from scientific knowledge, can allow us to solve planning problems by some form of dialogue between individual

intuitions leading through some magic mutual learning to a solution to the problem. For them we can dispense with the paradigm altogether. I will not dwell on this point of view any further. The second category of critics attacks the universality of the paradigm although for diverse reasons. A third category of critics attacks the assumption of perfect information about the goals and the consequences and the assumption of exhaustive search among alternatives. This category of criticisms leads to the idea that we can reach only a "bounded rationality": instead of finding the optimal solution to a problem, we can only *satisfice* and obtain a good, if not optimal solution (see March and Simon, 1958). A fourth category of critics attacks the "rational paradigm" on the ground that goals, supposed to be somehow the outcome of the political process, are taken as given in this view of the planning process: some think that the planners should be concerned more with the definition of goals than with the other parts of the process; some propose a cyclical planning process whereby the goals would be revised after each iteration by some institutional arrangement involving the experts and some form of public participation. Others reject the paradigm altogether in favor of pure public participation. We will examine in turn each of the last three categories of criticisms.

The universality of the paradigm is criticized by Goldstein and Noyelle (1977) who are concerned with Harris' views and Scott and Roweis (1977) who are addressing their criticisms to the paradigm in general. For Goldstein and Noyelle, "having abstracted his model from social and historical practice, Harris implicitly presents the kind of economic rationality which governs capitalism and capitalist planning as a univer-

sal, structural basis of the organization of every society". For Scott and Roweis, "mainstream planning theory engages in a form of generalization that we might designate as indeterminate *abstraction* and given this proclivity, mainstream theory appears not so much to be incorrect as it is simply trivially true. For example, assertions that the planning process involves various forms of goal formulation, evaluation, implementation and control, learning, and all the rest, are no doubt true, but they are also plainly vacuous. This is not a vacuity that emerges from a lack of complexity in the basic systems model, as such, but from a fundamental failure to take any sort of intellectual and scientific risks. Quite simply, and to put the matter in Popperian terms, mainstream theory is structured for minimum rather than maximum refutability. This is precisely because mainstream theory fairly consistently refrains from ascribing anything but the most vapid empirical content to its basic units of analysis (goal formulation, evaluation etc.). Thus, just at the point where mainstream planning theory stops short, the really important and puzzling analytical tasks of a truly scientific theory begin. As a result of its indeterminate abstraction, immunizing it against refutability, mainstream theory tends to impede scrutiny of the real world of urban planning, and consequently, to license false consciousness and cognitive myopia".

These criticisms are not valid: they fail to distinguish between normative and positive theories of planning. This is clear in the two quotations above. Goldstein and Noyelle's argument does not resist close examination: it is hard to see how a normative theory in *itself* can be apologetic of anything; it is only by *omission*, i.e. if no other planning

theory was taught for instance, that it could become *indirectly* apologetic by its exclusivity. Similarly, the allusion to *refutability*, borrowed from Popper, makes clear that Scott and Roweis criticize the "rational paradigm" as if it were a positive theory, which it is not. It seems to me that Goldstein and Noyelle or Scott and Roweis's arguments are misplaced. What these authors are criticizing implicitly is the positivist epistemology of most people proposing or using this paradigm, and the related belief in the "objectivity" or "rationality" of the solutions obtained. They are also criticizing implicitly the *exclusive* emphasis on methodology at the expense of a positive theory that would try to explain the origin of planning institutions and of planning problems as they are perceived by planners. The origin of the emphasis on methodology is the belief that the major failures of urban planning to-day are failures in thought processes and in methodology rather than the natural results of economic and social forces in society at large. The first belief appears to be that of Britton Harris (1975, 1978) while the second is shared by Roweis and Scott (1977). To summarize, these critics fail to differentiate the rational paradigm as such from a "package" of which it seems to be a part: this package would contain the rational paradigm, the idea that failures of planning are essentially failures of methodology, and a positivist epistemology. I think that one can abandon the last two items of this "package" without abandoning the first.

The last two categories of criticisms on the other hand seem valid, as well as the accompanying ideas of "bounded rationality" and "cyclical planning process", but, again, they can be viewed in different lights depending on one's epistemology. In order to discuss this more thoroughly,

I will follow Britton Harris (1975, 1978) and use mathematical programming as a paradigm for the rational planning process. Within this terminology the fourth class of critics says that the objective function and the constraints come from outside the planning process and the third class of critics says in effect that the true dimensionality of the problem-space is not known and that in general there is no exhaustive search procedure. However most of the latter critics tend to think that, if, somehow, one could have all the relevant dimensions of the problem-space and could search the latter exhaustively, one could reach the optimal solution, given the objective function and the constraints: the planning problem is viewed as purely technical. This assumes implicitly an empiricist epistemology, in the sense that the dimensions are seen as non problematical, the only problem being to be aware of all of them. For a dialectical epistemology however, not only the objective function and the constraints are problematical, but the problem-space as well, in the sense that it has no objectivity: different theories of urban form would lead to different ways of structuring the problem or to not stating it at all. In this view, design models and predictive models are not only mutually dependent, but paradigm-dependent. The problem-space and the underlying theories depend on the world-view and the values of the expert or of the social group to which he belongs.

To sum up, we can only reach a "bounded rationality" within a "conditional rationality": within a certain world-view (or paradigm), and the resulting planning problem, i.e. once the problem-space, the objective function and the constraints are stated, the "rational paradigm" keeps its validity: the problem must still be solved. For instance, once it has been decided

that a new town should be built, with such and such objectives in mind and assuming such and such theories of human behavior, it may still not be a trivial problem to solve (combinatorial explosion, non-convexities, existence of many local optima, etc...). This question however belongs to the theory of design rather than to the theory of planning.

Indeed the theory of design, also called the theory of problem-solving, has attracted the attention of researchers in many fields, for instance researchers in artificial intelligence such as Simon and Newell (see Simon, 1969; Simon and Newell, 1972). Recently Harris (1978) has thoroughly explored the implications of using mathematical programming as a paradigm for design and his book constitutes the basis for a valid theory of design in a social context. In addition to exploring some of the "intrinsic" difficulties of planning such as the existence of local optima, he shows how certain styles of problem-solving are really "truncated" problem-solving methods. This suggests ways in which planning styles could be improved. Different professions adopt different styles of solving problems, according to their training and to their usual way of thinking: the focus on constraints constitutes the architects' approach which consists in setting "design standards" towards which to strive; the focus on prediction and evaluation leads to the "cost-benefit" tradition of planning, in which professionals with an economic training are prominent. In the first case tradeoffs between objectives are not permitted. In the second case the problem-space is not sufficiently explored.

Role and nature of a theory of planning

The preceding discussion explicitates the difference of focus between a theory of planning and a theory of design. The former would be essentially an explanatory theory concerned with substantive issues while the latter would be dealing with methodological issues such as search procedures, predictive techniques or evaluation techniques.

A theory of planning would be a reflexion on the practice of planning. It would therefore be an *epistemology* of planning which would attempt to explain the manner in which planning is practiced, how "problems" and institutions appear. Since knowledge and action are in dialectical interaction with each other, it would be concerned with explaining models and theories as well. It would be aimed, for instance, at uncovering the assumptions implicit in the way in which planning problems are stated and solved. It would replace planning within its general social context, i.e. it would relate it to the political, economic, philosophical or ideological spheres as well as to the state of the natural and social sciences. Like epistemology in general it would be concerned with questions of fact and questions of validity and would therefore have to use two kinds of methods: genetic methods and formalization.

For the genetic part, such a theory of planning would have to rely on a theory of ideologies and metaphysical systems and on the sociology of knowledge, as well as on political science and economic history. It would explain the evolution of practice and of different theories (or metaphors) of the city. In addition to using a genetic or historical approach[1], planning theory would attempt to formalize the manner in which planning

1 Good examples of this approach are to be found in Goldstein and Noyelle (1977) and Wilson (1975).

problems are formulated and solved in the present as well as in the past. The advantage of formalization would be to make explicit belief systems as well as the underlying assumptions of planning practice such as different theories (or metaphors) of the city.

Comparison with other points of view

I believe in the joint necessity of a theory of design and of a theory of planning. Since as far as "design" is concerned, my ideas are closest to those of Harris and since my ideas on "planning theory" are closest to those of Scott and Roweis, Goldstein and Noyelle, it may be worth at this point to state clearly my areas of agreement or of disagreement with these different authors. In addition, given the importance of Faludi's books in the planning field, I will contrast my ideas with his.

Unlike Faludi, I do not believe in the "generality" of a positive theory of planning. For Faludi (1973a), "a positive theory of planning treats its subject-matter as a researchable phenomenon: it assumes that planning shows enough constancy to warrant the formulation, in the long run, of "general laws", which, ideally at least, would explain its recurring aspects and allow making predictions about planning. Such general laws of planning might also be transformed into "prescriptions" concerning improvements to the institutions and the style of planning based on planning knowledge". I believe myself that there are no such general laws. We should take a historical approach and consider that different societies generate planning institutions and theories differently. The correct

concept would be that of a "planning community" analogous to Kuhn's concept of a "scientific community".

On the other hand I agree with Scott and Roweis' (1977) following statement on the nature of a theory of planning: "analytical derivation of the nature, content and trajectory of urban planning out of those relatively durable social phenomena in which urban planning is embedded as opposed to a purely inductive derivation of urban planning, out of the myriad short run circumstances that encompass observable planning events". I would essentially add to this definition the epistemology of theories, models and metaphors, as well as the study of ideas about the planning process itself.

As discussed in a previous paragraph, I do not agree with the rejection of a "normative theory" of planning. I find it neither vacuous nor apologetic and I think that Harris' book (1978) provides such a normative theory. However I think that Harris claims too much scope for his theory of design. For instance he states (see Harris, 1975) "that the optimal design of processes and organizations is perhaps even more complex than the optimal design of policies, but the use of the paradigm can be fruitful in defining more accurately the nature of these difficulties". It is only in a utopian and idealistic sense that institutions, organizations and processes are amenable to the same kind of "optimizing" as, say, a transportation network: there may not be any "subject" for deciding on the appearance of fundamental planning institutions and to whom Harris' paradigm could be useful. Goldstein and Noyelle (1977) distinguish between planning at level I, concerned with "the reorganization and

design of institutions with a more or less well defined function" and planning at level II which is the "design, implementation and administration of programs within these basic institutional structures". I find this distinction quite valid and I would contend that Harris' paradigm is essentially useful for planning at level II, not for planning at level I. Planning at level I cannot be "planned" but only "explained". There are discontinuities in the "facts of planning" which have to be recognized: only for specific problems, already well situated in time and space, within the context of existing institutions, is there a "subject" that "plans". This fact does not prevent the theory of design to be as important as the theory of planning for the progress of the urban planning field.

CONCLUSION

In this paper we presented the implications of Piaget's genetic epistemology for the relationship between knowledge and action. This lay the foundation of our belief that social science and planning cannot be completely objective and value-free and that a theory of design and a theory of planning are both extremely important. Put in their proper perspective, i.e. their *conditional* nature, concepts of optimality and rational decision-making have an important role to play in planning practice and research, as part of a theory of design. It is the role of planning theory to situate these concepts. By its self-reflexive function and the importance it attributes to uncovering hidden beliefs and assumptions as well as by the importance it attributes to social theory, planning theory should make

the planner were aware of his social responsibilities. A proper balance between the development and teaching of planning theory and design theory is necessary for the progress of urban planning.

REFERENCES

Alonso, W. (1964) Location and Land Use. Harvard University Press, Cambridge.

Apostel, L. (1967) Logique et dialectique. In Logique et connaissance scientifique, Jean Piaget, editor. Gallimard, Paris.

Baran, P. and Sweezy, P. (1966) Monopoly Capital. Monthly Review Press, New York.

Benassy, J.P. (1976) Théorie du déséquilibre et fondements micro-économiques de la macroéconomie. Revue Economique 755-804.

Benetti, C. (1975) Valeur et répartition. Presses Universitaires de Grenoble/François Maspero, Grenoble.

Benetti, Berthomieu, Cartelier (1975) Economie classique, économie vulgaire. Presses Universitaires de Grenoble/François Maspero, Grenoble.

Beth, E.W. et Piaget, J. (1961) Epistémologie mathématique et psychologie. Presses Universitaires de France, Paris.

Boutaud, D., (1978) Quelques réflexions critiques sur les théories de la rente foncière urbaine. Publication # 89, Centre de recherche sur les transports, Université de Montréal.

Davidoff, P. (1965) Advocacy and pluralism in planning. Journal of the American Institute of Planners 31.

Davidoff, P. and Reiner, T.A. (1962) A choice theory of planning. Journal of the American Institute of Planners 28, 102-115.

De Gaudemar, J.P. (1976) Mobilité du travail et accumulation du capital. François Maspero, Paris.

Delong, H. (1970) A Profile of Mathematical Logic. Addison-Wesley.

Dobb, M. (1973) Theories of Value and Distribution Since Adam Smith. Ideology and Economic Theory. Cambridge University Press, Cambridge, U.K.

Dostaler, G.(1978a) Valeur et prix - Histoire d'un débat. François Maspero/Presses Universitaires de Grenoble /Les Presses de l'Université du Québec, Montréal, Canada.

Dostaler, G. (1978b) Marx, la valeur et l'économie politique. Editions M8-Anthropos, Paris.

Dumont, L. (1977) Homo aequalis - Genèse et épanouissement de l'idéologie économique. Editions Gallimard, Paris.

Faludi, A. (1973a) (Editor) A Reader in Planning Theory. Pergamon, Oxford.

Faludi, A. (1973b) Planning Theory. Pergamon, Oxford.

Faludi, A. (1978a) Essays in Planning Theory and Education. Pergamon, Oxford.

Faludi, A. (1978b) Beyond planning theory. 18th European Congress of the Regional Science Association, Fribourg, Switzerland, August 29th to September 1st, 1978.

Fradin, J. (1976) Les fondements logiques de la théorie néoclassique de l'échange. Presses Universitaires de Grenoble/François Maspero, Grenoble, France.

Fradin, J. (1977) Recherches sur l'analyse économique de l'ordre social. Document de travail no. 8, Département de sciences économiques, Faculté de droit et des sciences économiques et politiques de Besançon, Besançon, France.

Friedmann, J.(1973) Retracking America: A Theory of Transactive Planning Doubleday, Garden City, New York.

Friedmann, J. and Hudson, B. (1974) Knowledge and action: a guide to planning theory. Journal of the American Institute of Planners

Furth, H.G. (1969) Piaget and Knowledge-Theoretical Foundations. Prentice-Hall.

Gale, S. (1975) On a metatheory of planning theory. In 1975 Symposium on Planning Theory, edited by R.H. Wilson and T. Noyelle, Papers in Planning # 1. Department of City and Regional Planning, University of Pennsylvania, Philadelphia, Pennsylvania.

Gale, S. (1977) Paradigms and counter-paradigms or "Does neatness count in planning theory?". In 1976 Symposium on Planning Theory, edited by T. Noyelle, Papers in Planning # 2. Department of City and Regional Planning, University of Pennsylvania, Philadelphia, Pennsylvania.

Goldmann, L. (1966) Sciences humaines et philosophie. Gonthier, Paris.

Goldmann, L. (1967) Epistémologie de la sociologie. In Logique et connaissance scientifique, J. Piaget, editor, Gallimard, Paris.

Goldmann, L. (1970) Marxisme et sciences humaines. Gallimard, Paris.

Goldstein, H. (1975) Towards a critical theory of planning. In 1975 Symposium on Planning Theory, edited by R.H. Wilson and T. Noyelle, Papers in Planning # 1. Department of City and Regional Planning, University of Pennsylvania, Philadelphia, Pennsylvania.

Goldstein, H. and Noyelle, T. (1977) Planning and social practice: a theory of capitalist planning in the U.S. In 1976 Symposium on Planning Theory, edited by T. Noyelle, Papers in Planning # 2. Department of City and Regional Planning, University of Pennsylvania, Philadelphia, Pennsylvania.

Grize, J.B. (1967) Historique - Logique des classes et des propositions - Logique des prédicats - Logiques modales. In Logique et connaissance scientifique, J. Piaget, editor, Gallimard, Paris.

Habermas, J. (1970) Towards a Rational Society. Beacon Press, Boston.

Habermas, J. (1971) Knowledge and Human Interests. Beacon Press, Boston.

Habermas, J. (1973) Theory and Practice. Beacon Press, Boston.

Habermas, J. (1975) Legitimation Crisis. Beacon Press, Boston.

Harris, B. (1966) The uses of theory in the simulation of urban phenomena. Journal of the American Institute of Planners 32, 5.

Harris, B. (1967) The limits of science and humanism in planning. Journal of the American Institute of Planners 33, 324-335.

Harris, B. (1968a) People, problems and plans: the purpose and nature of design. Transaction of the Bartlett Society 7, 9-53

Harris, B. (1968b) The city of the future: the problem of optimal design. Papers and Proceedings of the Regional Science Association.

Harris, B. (1975) A fundamental paradigm for planning. In 1975 Symposium on Planning Theory, edited by R.H. Wilson and T. Noyelle. Papers in Planning # 1. Department of City and Regional Planning, University of Pennsylvania, Philadelphia, Pennsylvania.

Harris, B. (1978) A Paradigm for Planning. (in preparation).

Harvey, D. (1973) Social Justice and the City. The Johns Hopkins University Press.

Herbert, D.J. and Stevens, B.H. (1960) A model for the distribution of residential activity in urban areas. Journal of Regional Science 2, 21-36.

Hewitt, C. (1971) Procedural embedding of knowledge in PLANNER. In Proceedings of the 2nd Conference on Artificial Intelligence, London, U.K.

Horkheimer, M. (1972) Critical Theory. Herder and Herder, New York.

Jay, M. (1972) The Dialectical Imagination. Little, Brown and Co., New York,

Kuhn, T.S. (1962) The Structure of Scientific Revolutions. University of Chicago Press, Chicago.

Kuhn, T.S. (1970a) Logic of discovery or psychology of research. In Criticism and the Growth of Knowledge, edited by I. Lakatos and A. Musgrave. Cambridge University Press, Cambridge, U.K.

Kuhn, T.S. (1970b) Reflections on my critics. In Criticism and the Growth of Knowledge, edited by I. Lakatos and A. Musgrave, Cambridge University Press, Cambridge, U.K.

Kuhn, T.S. (1974) Second thoughts on paradigms. In The Structure of Scientific Tehories, edited by F. Suppe, University of Illinois Press.

Ladrière, J. (1967) Limites de la formalisation. In Logique et connaissance scientifique, edited by J. Piaget, Gallimard, Paris.

Lipietz, A. (1974) Le tribut foncier urbain. François Maspero, Paris.

Lipietz, A. (1977) Le capital et son espace. François Maspero, Paris

March, J.G. and Simon, H.A. (1958) Organizations. John Wiley, New York.

Meyerson, M. and Banfield, E. (1955) Politics, Planning and the Public Interest. Glencoe: The Free Press.

Minsky, M. and Papert, S. (1972) Artificial intelligence progress report. A.I. Memo no. 252, Massachusetts Institute of Technology.

Piaget, J., editor (1967a) Logique et connaissance scientifique. Gallimard, Paris.

Piaget, J. (1967b) Introduction et variétés de l'épistémologie. In Logique et connaissance scientifique, J. Piaget, editor, Gallimard, Paris.

Piaget, J. (1967c) Les méthodes de l'épistémologie. In Logique et connaissance scientifique. J. Piaget, editor, Gallimard, Paris.

Piaget, J. (1967d) Epistémologie de la logique. In Logique et connaissance scientifique, J. Piaget, editor, Gallimard, Paris.

Piaget, J. (1967e) Biologie et connaissance. Gallimard, Paris.

Piaget, J. (1967f) Les deux problèmes principaux de l'épistémologie des sciences de l'homme. In Logique et connaissance scientifique, J. Piaget, editor, Gallimard, Paris.

Piaget, J. (1972) L'épistémologie génétique. Presses Universitaires de France, Paris.

Piaget, J. (1978) L'équilibration des structures cognitives - Problème central du développement. Presses Universitaires de France, Paris.

Popper, K.R. (1972) The Logic of Scientific Discovery. Hutchinson, London, U.K.

Ricardo, D. (1970) Principes de l'économie politique et de l'impôt. Calmann-Lévy, Paris.

Richardson, H.W. (1977) The New Urban Economics: and Alternatives. Pion, London, U.K.

Roweis, S.T. and Scott, A.J. (1977) The urban land question. In Urbanization Processes and Conflict in Market Societies, K. Cox, editor, Maaroufa, Chicago.

Scott, A.J. (1976) Land use and commodity production. Regional Science and Urban Economics 6, 2, 147-160.

Scott, A.J. (1978) Urban transport and the economic surplus: Notes towards a distributional theory. In Spatial Interaction Theory and Planning Models, edited by A. Karlqvist, L. Lundqvist, F. Snickars, J. Weibull. North-Holland, Amsterdam, The Netherlands.

Scott, A.J. and Roweis, S.T. (1977) Urban planning in theory and practice: a reappraisal. Environment and Planning 9, 1097-1119.

Simon, H.A. (1969) The Sciences of the Artificial. M.I.T. Press.

Simon, H.A. and Newell, A. (1972) Human Problem-Solving. Prentice Hall.

Sraffa, P. (1960) Production of Commodities by Means of Commodities. Cambridge University Press, Cambridge, U.K.

Suppe, F. (1974) The search for philosophic understanding of scientific theories. In The Structure of Scientific Theories, F. Suppe, editor. University of Illinois Press.

Thünen, J.H. von (1966) Der Isolierte Staat in Beziehung auf Nationalökonomie und Landwirtschaft (Gustav Fischer, Stuttgart) Reprint of 1826.

Wilson, R.H. (1975) Has planning theory forgotten its history? In 1975 Symposium on Planning Theory, edited by R.H. Wilson and T. Noyelle, Papers in Planning # 1. Department of City and Regional Planning, University of Pennsylvania, Philadelphia, Pennsylvania.

Winograd, T. (1971) Procedures as a Representation for Data in a Computer Program for Understanding Natural Language. MAC TR-84, M.I.T.

Winston, P. (1970) Learning Structural Descriptions from Examples. MAC TR-76, M.I.T.